IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Bruce Gordon Ramsay

Group Art Unit: 1762

Serial No.: 10/621,700

Examiner: Eric B. Fuller

Filed: July 17, 2003

Attorney Docket: 99A429

Assignee: The BOC Group, Inc.

Title: VACUUM CHAMBER LOAD LOCK STRUCTURE AND ARTICLE TRANSPORT MECHANISM

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF PRIOR INVENTION IN THE UNITED STATES OR IN A NAFTA OR WTO MEMBER COUNTRY TO OVERCOME CITED PATENT OR PUBLICATION (37 C.F.R. § 1.131)

SIR:

CERTIFICATE OF MAILING

I hereby certify that this correspondence and every writing referred to herein as being enclosed is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on January 23, 2006.
(Date)

Betty Lee
Printed name of person signing this certificate

Betty Lee
Signature of person mailing

PURPOSE OF DECLARATION

1. This declaration is to establish completion of the invention of this application in the United States at a date prior to December 17, 1999, that is, the effective date of the prior art patent 6,429,129 B1 that was cited by the Examiner.

2. The person making this declaration is an attorney of record in this application (and a suitable explanation as to why it is not possible to produce the declaration of the inventor(s) is given in Attachment A).

FACTS AND DOCUMENTARY EVIDENCE

3. To establish the date of completion of the invention of this application, the following attached documents and/or models are submitted as evidence in Exhibit 1: an Invention Record.

4. From this document, the invention in this application was made at least by a date earlier than December 17, 1999, and upon information and belief which is a date earlier than the effective date of the cited reference (6,429,129 B1).

DILIGENCE

5. The following statements establish the diligence of the applicants, from the time of their conception, to a time just prior to the date of the reference, up to the filing of the application.

i. On a date prior to December 17, 1999, the effective date of the cited reference (6,429,129 B1), The BOC Group's (BOC's) Intellectual Property department received an invention record directed to the subject matter of this application.

ii. From a date prior to the effective date until June 30, 2000 the invention record remained in BOC's Intellectual Property department.

iii. On June 30, 2000 BOC's Intellectual Property department sent a list of open invention records, including the above-mentioned invention record, to former employee Russ Hill, the former head of Technology of BOC's Coating division of Temescal as shown in Exhibit 2: List of Open Invention Records.

iv. From June 30, 2000 until August 8, 2000, the invention record remained with BOC's Intellectual Property department.

v. On August 8, 2000, the invention record was sent to outside counsel, Gerald P. Parsons, Esq., for the preparation and filing of a patent application directed to the invention in the invention record as shown in Exhibit 3: Letter to Gerald P. Parsons.

vi. During the period of August 8, 2000 until the patent application was filed on October 4, 2000, outside counsel, Gerald P. Parsons, worked toward completing the patent application for filing.

TIME OF PRESENTATION OF THE DECLARATION

This declaration is submitted prior to final rejection.

DECLARATION

As a person signing below, I hereby declare that all statements made herein of my own knowledge, are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false

statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

7. **Attorney of Record for the Assignee**

Philip H. Von Neida
Name of person signing

Signature

JANUARY 23, 2006
Date

The BOC Group, Inc.
Name of assignee

575 Mountain Avenue
Murray Hill, NJ 07974
Address of assignee

Assignment recorded in PTO on February 8, 2001
Reel 011520 Frame 0847

ATTACHMENT A

Explanation as to Why it is Not Possible to Produce the Declaration of the Inventor

1. The inventor of this application, Bruce Gordon Ramsay, no longer works for The BOC Group, Inc, and his whereabouts and contact information are unknown.

EXHIBIT 1
Invention Record

PATENT DEPARTMENT
Redacted
DOCKET 12 PVN

INVENTION RECORD

Date Submitted: Redacted

Patent Project No.: 99A429
(To be filled in by Patent Dept.)

DIVISION OR DEPARTMENT:

BOC Coating Technology

1. SUGGESTED TITLE FOR PATENT PROJECT:

Fast cycle load lock and substrate carrier transfer mechanism

2. BRIEF DESCRIPTION of INVENTION:

.This invention is a means of conveying a substrate or substrate carrier to a load lock, a mean of isolating the load lock from the main vacuum chamber, and a load lock that minimizes volume and surface area.

3. DETAILED DESCRIPTION OF INVENTION: (Describe preferred embodiment in detail and state variations and modifications. Give structure, mode of operation and results if Machine; give details of structure and use if Article; give steps and results if Process; give components, proportion, synthesis and utility if Composition Matter.)

Redacted

see attachment "Improved deposition tool load lock description," dated Redacted

4. KNOWN PRIOR PUBLICATIONS, PATENTS, AND OTHER PRIOR ART:

5. ADVANTAGES OF THE INVENTION OVER THE PRIOR ART:

Presently evaporation systems vent a product chamber which has a large volume and surface area and contains deposition shields which have a large surface area and are usually coated with the source material. These large load locks are ineffective at reducing pump down time or preventing contamination of the deposition environment.

Present conveying systems used in vacuum system utilize long bellows, chains, lead screws or other mechanism which are expensive and may contribute particulate contamination or act as sources of gas contaminants.

Present deposition systems occasionally utilize a load lock, but do not isolate the chamber as well as this design. Most load lock design utilize a gate valve which isolates a considerably larger volume.

6. **ASSERTION OF INVENTORSHIP: (Name(s) of person or persons, if any, who claim inventorship.)**

Bruce Ramsay

7. **CONCEPTION DATE: (Identify any records relied on and attach copies.)**

Redacted

8. **DATE FIRST SKETCH OR DRAWING WAS MADE: (Identify and attach copy.)**

Redacted (incorporated in attached proposal dated Redacted)

9. **DATE FIRST WRITTEN DESCRIPTION WAS MADE: (Identify and attach copy.)**

Redacted

10. **DATE FIRST DISCLOSED TO ANOTHER: (State where, when and parties involved.)**

Redacted - Disclosed to RF Micro Devices Inc under an NDA in "Equipment Sepcification, RFMD GaAs backside sputter tool" dated Redacted marked confidential to BOC Coating Technology, copy attached.

11. **DATE OF ACTUAL REDUCTION TO PRACTICE: (State when and where; identify records relied on and attach copies, and give names of witnesses present.)**

to be done

(Attachments should be signed, dated, witnessed and referred to above)

WITNESSES:

Date: Redacted
Signature: Russell J. Hill

Date:
Signature: _____

Date:
Signature: _____

SUBMITTED BY:

Date: Redacted
Signature: _____ Eng Mgr
Title

Date:
Signature: _____
Title

Date:
Signature: _____
Title

Improved deposition tool load lock description Redacted

Bruce Ramsay
BOC Coating Technology

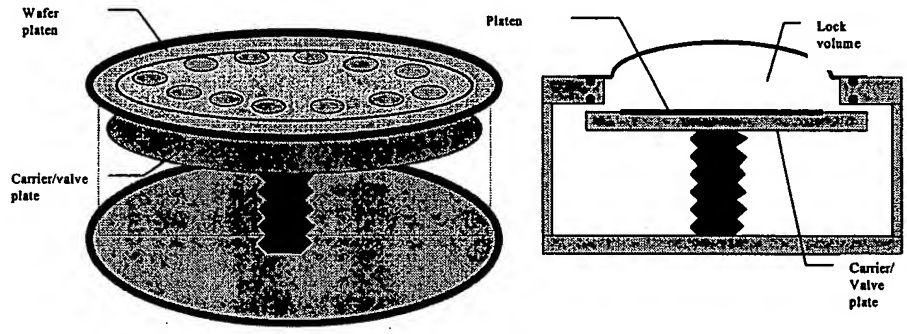
This invention includes

1. A high vacuum low particulate transfer mechanism with an inherently sinusoidal velocity profile.
2. A detachable valve plate which functions as both a sub carrier for the substrate or substrate carrier and as a valve surface for the load lock.
3. A means of pressing and sealing the valve/carrier plate against a load lock sealing surface.
4. A means of transferring the substrate or substrate carrier to a fixture for deposition.
5. A means of removing the carrier plate from the process chamber during deposition
6. A lock lid or door which provides isolation from the ambient environment and encloses a minimal volume and surface area.

Loading

The carrier/valve plate is lifted to seal against an o-ring in the lower side of the lid flange.
The lock vents.
The lid raises
The processed platen is removed by a robot or by the operator.

The next platen is manually or robotically loaded into the load lock.



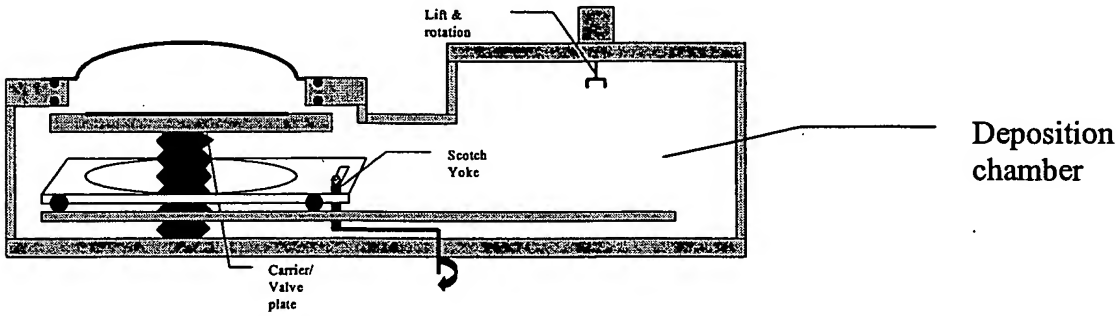
In normal operation an operator will load a pallet on a table while another pallet is in the system processing. When the pallet in process completes it will be automatically transferred to the lock chamber. The lock will vent and the operator will be signaled that a pallet is ready for unload

Transfer

The transfer mechanism uses a carriage assembly on a track with scotch yoke to move the plate from the lock to the process area. The valve plate with platen is lowered onto the carriage. The yoke moves the entire assembly into the process area using a simple rotary feed-through. The scotch yoke inherently provides a sinusoidal velocity curve, improved further by any acceleration or deceleration in the motor. The position accuracy is relatively insensitive to motor

position accuracy. This mechanism is used in standard Temescal gate valves and provides a high vacuum low particulate operation superior to chains, lead screws or bellows mechanisms.

A mechanism in the process chamber picks up the platen from above. The carriage and valve plate return to the lock area to make the top and bottom of the pallet accessible for deposition.



Lock Chamber

The chamber will be designed to permit the lock to be installed through the wall in a clean room.

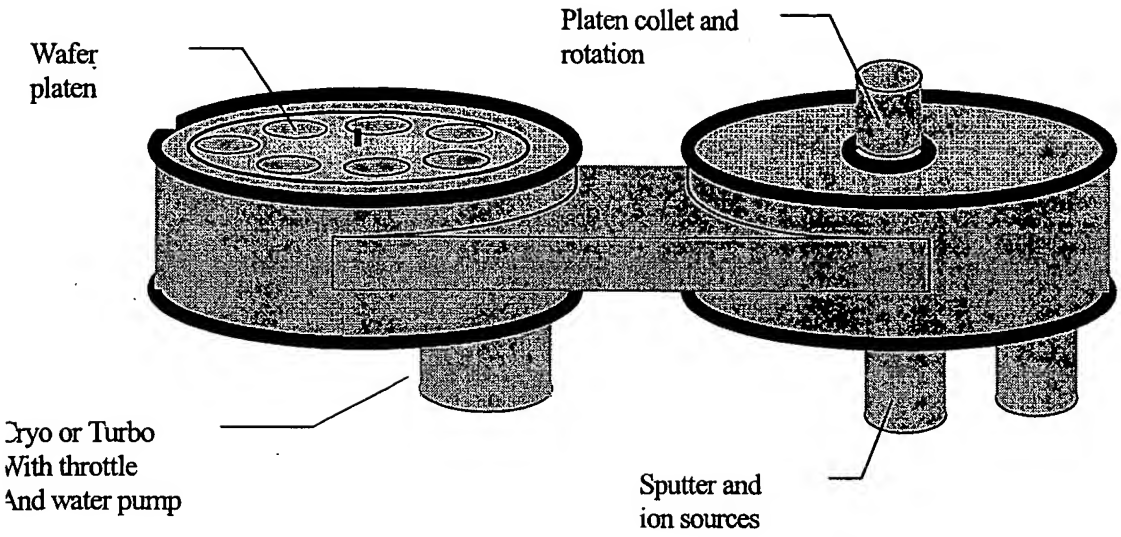
The lock chamber will be 304 stainless steel and will be sized close to the size of the pallet. The use of the carrier plate as the lock valve significantly reduces the volume and the surface area exposed during a vent.

Pumping will be by a blower/mechanical pump stack located below the lock chamber. Slow and fast rough valves will be provided. Fixed orifices will determine pumping time. Four to five minutes to cryo crossover is typical. This time is selected to reduce particulate contamination and condensation. The minimum mechanical pump time is much shorter.

High vac pumping will be through the cryo pump once the valve plate is lowered. The throttle louvers will be open to maximize pumping. The throttles will only be closed during process to reduce gas flow required to maintain process pressure.

The lock will be vented with nitrogen.

The valve plate design is based on the standard Temescal gate valve used on all of our load locked evaporators.



Equipment Specification
RFMD GaAs backside sputter tool

Customer Requirements

- Sputter AuGe 88%/12%
- 4-5000 Ångstroms
- 200 wafer per day net throughput
- Mask Sapphire ring and perimeter of wafer ~2mm into wafer
- Moderate particle requirement- probably no acceptance requirement.
- Class 1000 clean room in load area of machine. Bulk of installation in gray area.
- Through the wall installation with wall at lock chamber slot valve.
- 12 6" wafers per carrier
- Throttled cryo pump
- Base pressure TBD (presume 5x10-7 in 24 hours)
- +/-5% uniformity (need definition)

Customer Preferences

- Sputter up planar magnetron.
- Single ended single process chamber
- RF sputter etch
- 4" carrier version- adaptation of the 6" version
- CTI cryopumps- on-board preferred.
- Ibarra mechanical pumps

Specifications

Substrate

Six inch

The six inch nominal wafer is a 150mm wafer bonded to a 62-163mm sapphire carrier ring. The net coating area is approximately 145mm. The carrier must mask the sapphire carrier and the perimeter of the wafer. The assembly is less than 1mm thick.
The bonding agent will fail at 90°C.

Four inch

The four inch nominal wafer is in a 109mm diameter sapphire ring. The net coating area is 96mm. The carrier must mask the sapphire carrier and the perimeter of the wafer. The assembly is less than 1mm thick.
The bonding agent will fail at 90°C.

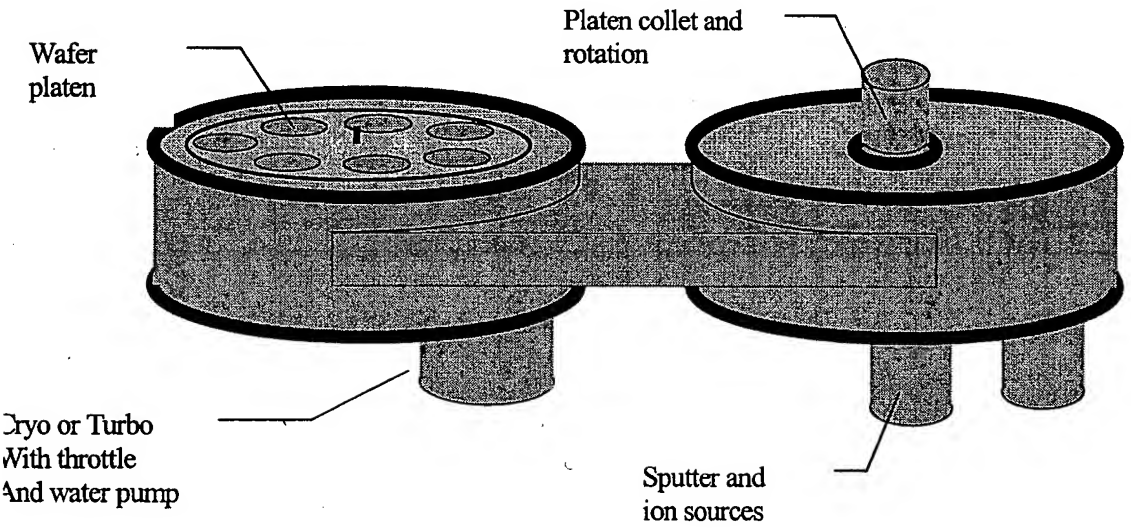
Scope of Supply

For each sputter system purchased BOCCT will supply

- One Lock chamber
- One Process
- Power distribution within the coating system from a reasonable number of power drops
- Rough and high vac pumping and valves and piping from closely located pumps to the system
- Process gas distribution within the coating system from connection points.
- A standalone PC/PLC based controls system and cabinet
- Two sets of internal deposition shields
- Four pallets
- Installation supervision and start-up and final acceptance at customers facility

BOCCT will NOT supply

- Gold target material
- Facility piping, wiring, wireway, conduit, enclosures, or equipment not listed herein,
- Labor for facilitization including but not limited to pipe fitters, plumbers, electricians, and riggers required for moving the tool into the fab and routing facilities to the connection points on the tool.



Loading

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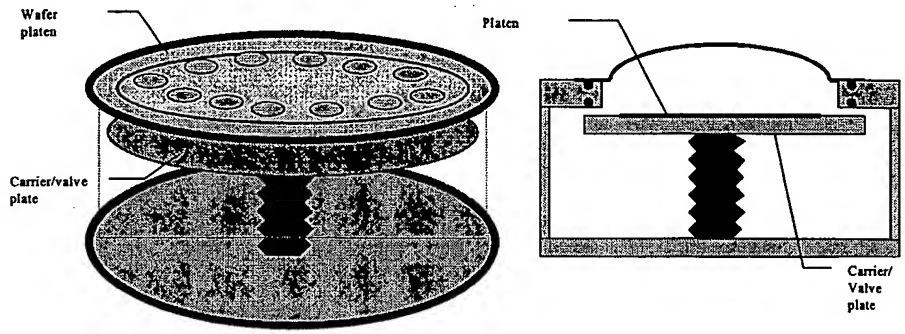
The lock vents.
The lid raises
The processed platen is removed by a robot or by the operator.

The next platen is manually or robotically loaded into the load lock.



In normal operation an operator will load a pallet on a table while another pallet is in the system processing. When the pallet in process completes it will be automatically transferred to the lock chamber. The lock will vent and the operator will be signaled that a pallet is ready for unload

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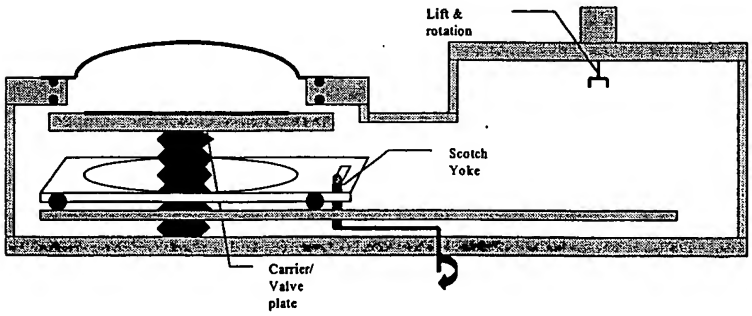
A mechanism in the process chamber picks up the platen from above. The carriage and valve plate return to the lock area to make the top and bottom of the pallet accessible for deposition.



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High vac pumping will be through the cryo pump once the valve plate is lowered. The throttle louvers will be open to maximize pumping. The throttles will only be closed during process to reduce gas flow required to maintain process pressure.

The lock will be vented with nitrogen.

The valve plate design is based on the standard Temescal gate valve used on all of our load locked evaporators.

Process chamber

The process chamber will be one 304 stainless steel weldment.

A slow/fast rough assembly will pump the process/overrun chamber after maintenance.
One cryo pump will pump the chamber from a plenum between the process and lock chambers. The pump will be isolated by a gate valve for regeneration. A throttle assembly will reduce conductance during process to reduce gas flow.

A trubo pump can be supplied in place of the cryo pump to eliminate regeneration.

MFCs will be utilized to control pressure. Gas supply lines for process and vent gases will be stainless steel pipe with VCR fittings.

A pirani or convectron type vacuum gauge will measure pressure from atmosphere through cryo crossover.
An ion gauge will measure base pressure.
A capacitance manometer will measure and control process pressure.

Gas flow will be distributed in the vicinity of the sources. Baffles and shields will be designed to capture gold efficiently and to promote uniform distribution of process gas in the coating area.

Process

Cleaning
An ion source is recommended for pre-process cleaning and is included in the estimate.
RF sputter etch is optional and would be done in the lock chamber.

Sources

Round or delta magnetrons may be used.
Four or six inch wafers are arranged in a single ring of 12 wafers.

Four source locations will be provided allowing for sequential materials, higher throughput, or longer production campaigns depending on how the sources are utilized.

The process recipe will provide options for continuous rotation during deposition or intermittent motion with pauses at the deposition locations. The software will include provision for indicating which positions on the pallet have wafers and will not deposit in locations which do not have wafers. Datalog will indicate which position is being tracked.

Throughput

A Net throughput between 1 and 2 platens per hour is reasonable and meets the 200 wafer per day goal with allowance for maintenance. Gross throughput could be as high as 600 wafers per day.

Temescal has recorded deposition rates up to 400 Ångstroms per second using a circular magnetron to deposit gold. A single magnetron operating in the intermittent mode would require approximately 12 seconds per wafer to deposit 5000 Ångstroms. Adding 15 seconds to index to the next wafer yields a 6 minutes duration to process 12 wafers.

The system operates in a simple sequential fashion. All operation times add for a total pallet process time.

Transfer time in or out of the process chamber is estimated to be 30 seconds.
Pump time is planned to be 9 minutes.
Vent time is planned to be 4 minutes.

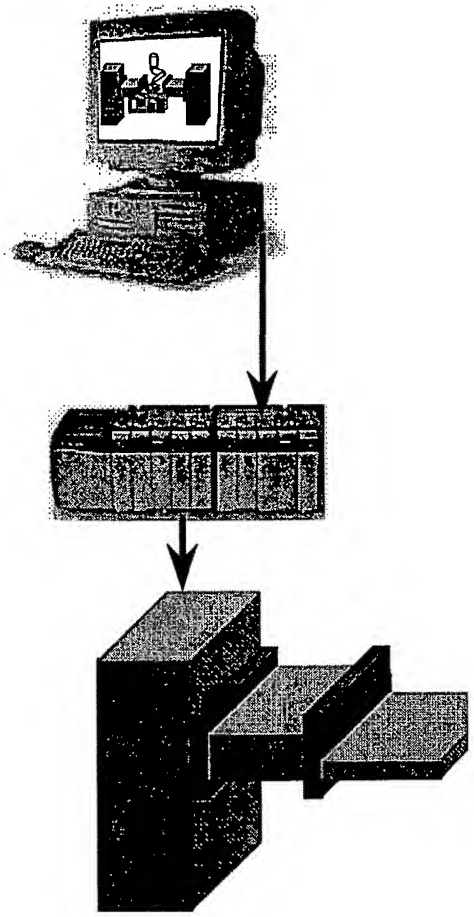
TACT time is 15 minutes. Pump and vent times are slowed to reduce particles and can be reduced.

Allow 6 minutes for cleaning.
Allow 6 minutes of deposition

Lock to lock time is 27 minutes. All of the times used are conservative. Overall time may be improved.

Controls

A PC user interface and PLC based machine control will operate the machine.



PC screens will be graphical for a quick intuitive status of the machine.

The PC will provide recipes to set up process, material control and tracking, maintenance access and diagnostics, alarms, and data logging.

The PC will not perform any real-time or process critical functions.

The PLC will perform all machine control, real-time process control, and interlocks.

The system will be capable of automatically process a pallet of wafers from the entry table back to the load lock or entry table.

Facilities

Gas

The system will require dry nitrogen vent gas and Argon process gas.

Gas usage to be determined.
Nitrogen is estimated to be $0.25m^3$ per hour. Demand will be $0.1m^3$ in 4 minutes roughly twice an hour.

Argon demand will be a steady flow.

Gas connections will be VCR.
Customer is to supply clean dry filtered gas.
Customer should supply a shut off valve at the connection point for maintenance.

Electrical

Electrical is assumed to be 208 VAC three phase.
Current to be determined. Connected load is estimated at 300 Amps. Operating load is estimated at 200 amps.

Water

Cooling water is required. Water usage is approximately 20 GPM per coating system. Inlet pressure must be less than 90 PSI gauge. Outlet back-pressure must be less than 30 PSIG. There must be at least 60 PSI net pressure drop across the coating system.

EXHIBIT 2
List of Open Invention Records

THE BOC GROUP

VIA FACSIMILE
Total Pages: 5

To:	Russ Hill	Division:	BOCCT/Fairfield
From:	Philip H. Von Neida	Date:	June 30, 2000
Subject:	Open Patent Docket BOCCT		

Russ,

Attached is my list of Invention Records for coating that are designated as open, unfiled.

Best regards,

PHVN

Enclosures
Disclosure Status Reports

PVN:bjl

Disclosure Status Report

Case Number	Division	Invention Status	Attorney	Inventors
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
99A429	ACTCO	Open	PVN	RAMSAY B

Title: FAST CYCLE LOAD LOCK AND SUBSTRATE CARRIER TRANSFER MECHANISM

Case Number	Division	Invention Status	Attorney	Inventors
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				
Redacted				

EXHIBIT 3
Letter to Gerald P. Parsons

THE BOC GROUP

100 Mountain Avenue Murray Hill New Jersey 07974-2064 USA
Tel: 908-665-2400 Fax: 908-771-6159

VIA FACSIMILE
Total Pages: 13

August 8, 2000

Gerald P. Parsons, Esq.
Majestic, Parsons, Siebert & Hsue
Four Embarcadero Center, Suite 1100
San Francisco, CA 94111-4106

RE: New Patent Filing in US
For: "Improved Load Lock Means"
Our Docket No.: ~~99A249~~ 99A429

Dear Gerry:

Pursuant to our conversation of this afternoon, attached is a copy of an Invention Record we wish you to prepare for filing in the US. As discussed, the sooner filed the better. The inventor, Bruce Ramsay, works at the Fairfield facility.

If you have any questions, please contact me at your earliest convenience.

Sincerely,

Philip H. Von Neida
Patent Counsel

Enclosure
Invention Record 99A429